應用小波轉換技術及類神經網路於電腦滑鼠二維方向控制之研究

Apply wavelet transform and artificial neural network to brain computer interface at two-dimension cursor control

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摘要

本研究的目的在利用人體在大腦不同狀態時，大頭皮質產生的 beta 腦波差異，發展出一套腦機界面（Brain-Computer Interface, BCI）來控制電腦滑鼠在螢幕上、下、左、右二維移動控制。目前有相當多的方法可以用來分析訊號的頻域資料，在眾多技術中，小波轉換技術在不穩定訊號分析處理上有絕佳的效果。它可以在時間軸上獲得很好的解析度，也適合用來分析不穩定的腦波訊號。我們更利用類神經網路將訊號分類來控制游標的移動。在離線的分析上，我們將頻率域中有顯著差異的腦波資料放進類神經網路來訓練，然後將訓練過後的類神經網路應用在即時的游標控制上。目前在二維方向（上、下、左、右）的游標控制已經可以達到 60.17% 的正確率，具初步實用價值。

關鍵字：腦機介面、游標控制、小波轉換、類神經網路

Abstract

The aim of this study is to build a brain-computer interface system based on the EEG through the cerebral cortex beta waves among different states . At present, there are many methods to analyze the frequency of signals. The Wavelet Transform has the best efficiency for analyzing the unknown signal frequency distribution. It can obtain a better resolution at time domain, and that is suitable for processing the instable EEG signals. For controlling the movement of cursor, we apply the artificial neural network to classify the processed signals into the directions of movement. From the off-line analysis, the frequency bands with significant difference were filtered out and used as training data for the artificial neural network. Then, the trained neural network was used to control the on-line cursor movement. The primary experiments showed that the correct ratio achieved 60.17% for two-dimension (up, down, left, and right) cursor movement. It achieves the preliminary practicability.

Keywords：*Brain Computer Interface (BCI), cursor control, wavelet transform, artificial neural network*